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| 1 | *Five* from:<br><br>Because it is error-free, corrective maintenance is not needed<br>Because there are no new situations likely to arise, adaptive maintenance is not needed<br>Perfective maintenance is needed to modify the code<br>...enhance/add to the software capabilities to increase its usefulness<br>Delete unused/obsolete functions to reduce the complexity/code size/resource requirements<br>Optimise the code to increase functional speed | 5 |

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| 2 | ***This question to be marked as a Level of Response.***<br>*Analyse requires that candidates explain the main points in detail, explaining their effectiveness and characteristics.*<br>**Level 3 (7–8 marks)**<br>Candidates will analyse in detail the differences between white box testing and black box testing.<br>There will be a reasoned statement concerning the effectiveness of both types of testing.<br>The information will be relevant, clear, organised and presented in a structured and coherent format.<br>Subject specific terminology will be used accurately and appropriately.<br>**Level 2 (4–6 marks)**<br>Candidates will explain the differences between white box testing and black box testing.<br>There will be a reasoned statement concerning the effectiveness of one of the types of testing.<br>For the most part, the information will be relevant and presented in a structured and coherent format.<br>Subject specific terminology will be used appropriately and for the most part correctly.<br>**Level 1 (1–3 marks)**<br>Candidates will describe the differences between white box testing and black box testing.<br>Answers may be in the form of a list.<br>There will be little or no use of specialist terms.<br>**Level 0 (0 marks)**<br>Response with no valid content.<br>Answers may make reference to e.g.:<br><br>White Box Testing is a testing method in which the internal structure/ design/ implementation is known to the tester.<br>Black Box Testing is a testing method in which the internal structure/ design/ implementation is NOT known to the tester.<br>In white box testing, programming knowledge is required; in black box testing it is not.<br>In white box testing, programming knowledge is in-house; in black box testing it is not.<br>White box testing needs access to a detailed design specification, black box testing does not.<br>White box testing needs knowledge of the implementation; black box testing does not. | 8 |

STUDENTS' RESOURCE



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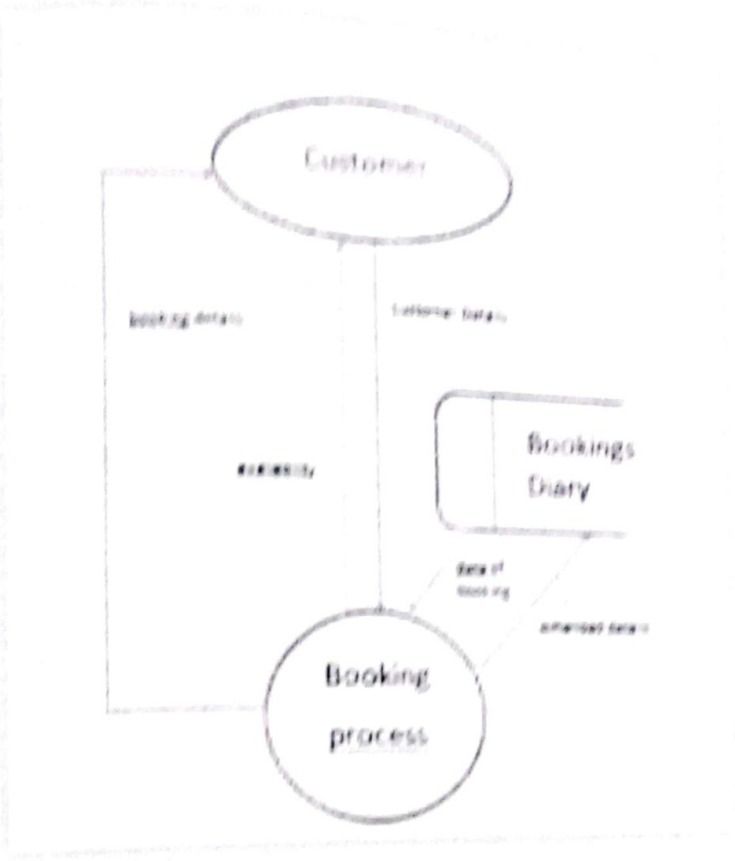
| 3 | *Eight from:* e.g.<br>  <br><br>Customer with appropriate shape<br>Diary store with appropriate shape<br>Booking process with appropriate shape<br><br>5 named arrows in correct direction | 8<br><br>1 mark<br>1 mark<br>1 mark<br><br>5 marks |

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| 4 | ***Eight** from:*<br><br>*Advantages:*<br>Increased quality of product<br>...focusses on problems that are critical to end users<br>...rather than technical problems of interest to developers<br>More likely to complete project on time<br>More likely to complete within budget<br>...method focuses on incremental development so chances of failure are reduced<br>More risk control<br>...the key risk factors show in the early part of the process<br>provides a flexible/adaptable process<br><br>*Disadvantages:*<br>Users are involved from the beginning and at all stages of the entire project...<br>...takes more interaction throughout the entire life-cycle between users and developers<br>...takes up the time of the experts<br>...costs are likely to be higher<br>RAD can be a new approach for some developers<br>...new tools/methods will be more likely to fail the first time as the team learns the process<br>Less control over the process as it is adaptable<br>Poor design of prototypes<br>...developers constantly make minor changes to individual components<br>...ignore overall system architecture issues that produce a better overall design<br>Not suitable for very large systems.<br><br>*Max 6 for all advantages or all disadvantages.*<br>*1 mark is available for a reasoned conclusion/opinion.* |

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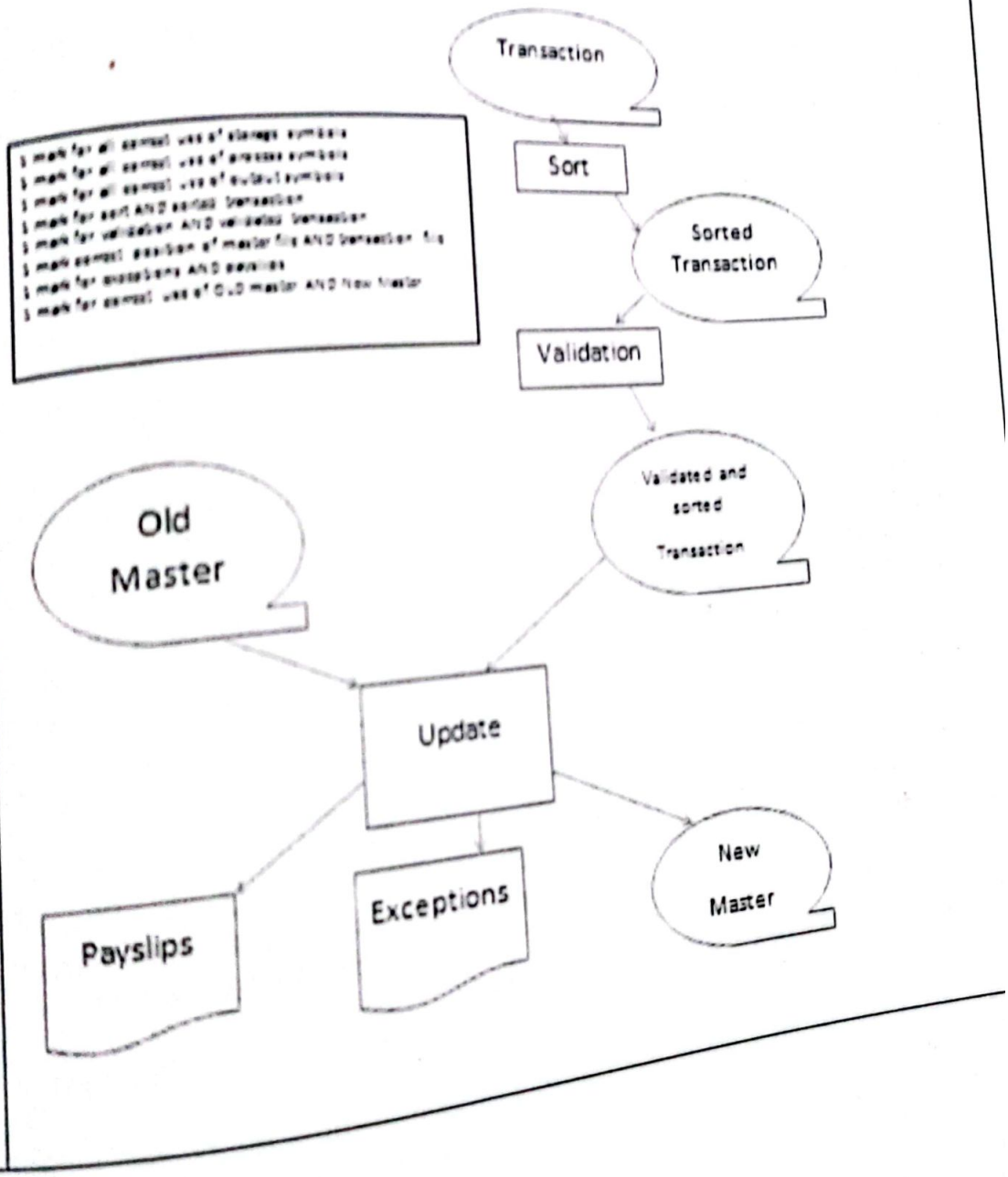
Transaction
Sort
Sorted Transaction
Validation
Validated and sorted Transaction
Old Master
Update
Payslips
Exceptions
New Master

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| 6(a) | ***Six** from:*<br><br>Waterfall/traditional is a linear approach to software development<br>Determine the software/system/game requirements<br>...produce a requirements document for the game application<br>Analyse the requirements<br>...produce a model/overview of what is required for the game application<br>Design the software<br>...produce e.g. system flowchart/DFD for the game application<br>Create the code<br>...program, document and test the code<br>...unit test the source code/modules for the game application<br>...integrate the units/modules into the whole system/game<br>Carry out whole system testing of the game application<br>remedy any errors/bugs found<br>...revisit any code with improvements/alterations as a result of testing<br>Carry out user acceptance testing (UAT) install<br>...remedy any issues discovered<br>Develop support mechanisms for users of the game application<br>Deliver/implement the finished product. | 6 |
| (b) | ***Eight** from:*<br><br>*Benefits:*<br>Problems can be found and fixed early in the processes<br>Emphasis on full documentation (requirements documents, design documents) means that individual team members can be replaced/no team member is irreplaceable/new teams can complete/carry on the work<br>Enforces a structured approach through separate/discrete stages...<br>...stages easy to understand<br>...provides identifiable milestones<br><br>*Drawbacks:*<br>Requirements not fully known before working software created<br>...clients may change their requirements<br>...requirements may not cover all details<br>...clients may not know exactly what they want/all the details required<br>...leading to increased costs due to redesign/redevelopment/retesting<br>Designers may be unaware of future difficulties of designing a new software product/feature.<br><br>*Max 6 marks for all benefits or all drawbacks.*<br>*1 mark is available for a reasoned conclusion.* | 8 |

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| | *Eight from:*<br><br>*Benefits:*<br>Allows tester to look inside system ('introspection')<br>...can identify system objects in code<br>...can reduce the failure rate of test code provided object names do not change<br>Can be more stable/allow re-use of test code provided object names do not change<br>More thorough/complete testing of code<br>...all aspects of code are tested<br>...every interaction in code/objects is tested<br>...all routes through code are tested<br><br>*Drawbacks:*<br>White box testing must be closely integrated with the system<br>...must be installed in the system to be tested<br>...cannot be sure that the testing is not causing the errors/problems it flags up<br>...cannot be sure that all platforms support the white box testing system changes to objects/code of system may cause white box testing to fail<br>...white box testing code is highly integrated with system code<br>...requires high degree of script maintenance<br>Tester must have in-depth knowledge of system<br>...be highly skilled programmer.<br><br>*Max 6 marks for all benefits or all drawbacks.*<br>*1 mark is available for a reasoned conclusion.* | 8 |
| 8 | *Six from:*<br><br>Technical documentation for programmer is needed<br>Program listing so she can see full details of the code<br>List of variables to follow the parameters as they are used<br>Program flowchart to see an overview of the program<br>Notes for future programmers so she knows where to start<br>Test plans and the results so these can be checked<br>Known errors/bugs so she can/attempt to correct these<br>Purpose of the software including reasons for choosing pieces of existing software instead of the programmer having to write new code<br>Input and output data formats so she can write code to match. | 6 |

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| 9(a)(i) | ***Four** from:*<br>Provides overview of all the testing<br>...systematic outline of all features/functionality<br>...continuously checked/updated to reflect risks<br>To prepare/ensure that all aspects of running a test are considered<br>To train those who need to assist with the test/communicate testing regime<br>Provides a mechanism for outlining test needs<br>...lists limitations<br>...lists reasons for testing so testing can be effective<br>Ensures that legal issues/regulations are met<br>...to show regulatory bodies that testing has been carried out/is effective. | 4 |
| (a)(ii) | ***Eight** from:*<br>Ensure that the writer of the test plan knows details of work to be taken/is competent in field of activity to be able to:<br>...define the aspects of the OS to be tested e.g. interface/devices that it will run on<br>...define test methods/how each part is to be tested/which aspects of smartphone is to be tested<br>...test OS use of smartphone facilities to ensure functionality<br>...assign tasks and responsibilities for testing the smartphone features<br>Test functionality of apps on the smartphone with new OS<br>Write a specific app to test specific features of smartphone with OS<br>Test OS with third party apps<br>Test ability to multi-task with apps from third parties/internal apps<br>...check regulations/legal issues<br>Test that the amount of smartphone memory is sufficient to hold/run the OS. | 8 |
| (a)(iii) | ***Eight** from e.g.*<br>*Benefits:*<br>Easy to use as testers do not need to know the inner workings of product<br>...tester need not know programming languages/how the software has been implemented<br>...can work through application as would a user<br>Test case can be developed quicker than for white box testing<br>...testers need only look at GUI<br>...do not need to discover all the internal paths/routes through software<br>....tests are done from point of view of a user<br>...can expose discrepancies in specification<br>Tests can be conducted by independent personnel from the developers allowing for an objective perspective<br>....ensures the avoidance of developer-bias<br>Test cases can be designed as soon as specification are complete<br>*Drawbacks:*<br>Test cases will be difficult to design as there is no clear test specification<br>Script maintenance may be difficult<br>...if the user interface is changing during development/changes due to testing<br>Scripts may not work/be fragile when testing<br>....GUI may not be the same for different tests<br>....GUI rendering may change during development<br>Does not test all internal pathways/all routes through software<br>...does not fully test the software<br>...many program paths will be left untested.<br>*Max 6 for all benefits or all drawbacks.*<br>*1 mark is available for a reasoned conclusion.* | 8 |

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| | Answers/Indicative content | |
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| 10 | *Evaluation requires that advantages and disadvantages be discussed and weighed up in importance.*<br><br>Answers may make reference to e.g.:<br>*Document analysis:*<br>• less time consuming than other methods/more efficient as it requires data selection rather than data collection<br>• many documents are readily available/in public domain<br>• documents unaffected by research process<br>• documents are stable/do not change due to observer's presence<br>• documents can be more exact/precise<br>• documents provide wide/broad coverage of topics<br><br>• documents may lack detail as not produced for research<br>• documents may be difficult to retrieve/locate<br>• documents may be incomplete<br><br>*Questionnaires:*<br>• relatively inexpensive to administer when large numbers are involved<br>• reduced researcher bias<br>• questionnaires are familiar to participants<br>• data can be collected in a format that is easy to analyse<br><br>• participants may not complete questionnaires/return the questionnaires fully/properly leading to incomplete data<br>• questions may not mean the same to all participants<br>• may be unclear who has completed the questionnaires<br>• unable to develop the questioning further<br>• questionnaires can be difficult to formulate<br><br>*Observation:*<br>• can collect data where/when activity occurs<br>• can be unobtrusive<br>• can provide 'behind the scenes' information/can directly see the activities<br>• can be susceptible to observer bias<br>• observed often perform better when watched<br>• cannot help understand why people behave as they do/do what they do | 8 |

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| | **This question to be marked as a Level of Response.**<br><br>**7–8 marks**<br>**Level 3**<br>Candidates will evaluate in detail use of at least two of document analysis, questionnaires, and observation for this research.<br>There will be a reasoned conclusion/opinion.<br>The information will be relevant, clear, organised and presented in a structured and coherent format.<br>Subject specific terminology will be used accurately and appropriately.<br><br>**4–6 marks**<br>**Level 2**<br>Candidates will evaluate the use of at least two of document analysis, questionnaires, and observation for this research.<br>There may be a reasoned conclusion/opinion.<br>For the most part, the information will be relevant and presented in a structured and coherent format.<br>Subject specific terminology will be used appropriately and for the most part correctly.<br><br>**1–3 marks**<br>**Level 1**<br>Candidates will describe use of document analysis, questionnaires, or observation for this research.<br>Answers may be in the form of a list.<br>There will be little or no use of specialist terms.<br><br>**0 marks**<br>**Level 0**<br>Response with no valid content. |
| 11 | *Four from:*<br><br>User/client may decide that the early version is all that is needed<br>Developers can focus on developing parts of the system that they understand<br>Instead of developing a whole system which might be beyond their comprehension<br>Improvements/alterations/add-ons to the system can be created later<br>First prototype is not discarded so materials/time are not wasted<br>Throw-away prototypes may not work at all/be on paper only<br>Can be used in interim until final system is complete. |

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| 12(a) | **Four** *from:*<br>The purpose of the software and its intended audience<br>The functions and capabilities of the software to be developed<br>The operational/user environment in which it will/should be used<br>The user interfaces to be used<br>The hardware interfaces that will be needed/hardware requirements<br>The software interfaces/interfaces to other software that will be needed<br>Communication protocols/interfaces<br>The performance levels of the software<br>The structure of the data elements to be used/developed<br>The reliability of the software<br>The security and privacy systems to be used<br>The safety systems/backup protocols/systems/methods to be used<br>The constraints/limitations of the software. | 4 |
| (b) | **Four** *from:*<br>To be part of the contract between the developers and the end user/purchaser/commissioning company<br>To provide a mandate/terms of reference for the design and development of the software/contain all the information to define the function of the new software<br>To provide a list of (testable) design criteria for the software/features to be included in the software<br>To list what the user expects the new software to be able to do<br>To ensure that all mandatory features (e.g. accessibility options) are included<br>To rank the features (required by end user) in order of mandatory, desirable, optional and possible future developments<br>To provide a set of success criteria against which the software can be tested/evaluated. | 4 |
| (c) | **One** *from:*<br>The wrong user may have been chosen so the user requirements are not accurate<br>The user requirements may change during the development cycle/lifetime of the project so the project becomes more complex/'mission creep'. | 1 |
| 13 | **Five** *from:*<br>*Choice of CPU:* CPU 1<br>Reference to CPU 1 running JavaScript faster than CPU 2<br>Tablets are often used to view web pages<br>Reference to CPU 1 having higher/better score on graphics performance than CPU 2<br>As tablets are often used to view video/movies<br>Reference to CPU 1 having higher/better score on physics calculation performance than CPU 2<br>Reference to CPU 1 having a worse/poorer physics calculation performance than its graphics performance<br>...which does not really matter in this context/use<br>As tablets are not used for/do not need to carry out 'heavy'/intensive gaming/complex modelling. | 5 |

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| 14 | Six *from:*<br><br>Accept/parse input from user<br>Check for a (single) space<br>Check that the characters are all alpharumeric/there are no non-alpharumeric characters (apart from the space)<br>Check that all letters are in upper case<br>(Separate and) check the first two characters of outward section/area code are letters<br>... and remainder of outward section/district code is '1 number' or '1 number + 1 letter'<br>(Separate and) check the inward section is in format '1 number + two letters'/check (sector code) is a number followed by two letters (for Unit code)<br>Use of length check to ensure that there are no more than 8 characters and no less than 7. | 6 |

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| 15 | *Five from:*<br><br>**Position in Flowchart** / **What is happening at the position**<br>**A** / (Checks) if the DOOR IS CLOSED, if not, goes back to setting temperature/spin speed/start else moves on to B<br>**B** / (Checks) if the TEMPERATURE IS SET, if not, goes back to setting temperature/spin speed/start else moves on to C<br>**C** / (Checks) if the SPIN SPEED IS SET, if not, goes back to setting temperature/spin speed/start else moves on to load setting and cycle starts<br>**D** / (Checks) if the STOP/CANCEL BUTTON IS PRESSED, if so, goes to STOP else moves to E<br>**E** / (Checks) if the TIME IS UP, if so goes to STOP else moves back to D | 5 |

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| 16 | **Eight** *from e.g:*<br><br>Laptop has these features required for sales<br>Physical keyboard for typing emails/product but smartphone usually onscreen keyboard<br>Large storage capacity/500GB for local storage of files whereas smartphone has only 32GB/limited file storage<br>Access to external/online storage for file exchange/backup<br>Laptop usually has an optical drive for s/w and product updates whereas the smartphone does not<br>Laptop has greater compatibility of software than a smartphone/can use most features of e.g. office applications<br><br>Smartphone has these features required for sales people when away from office<br>Smartphone can be used for SMS/text messages<br>Can make voice calls whereas a laptop cannot<br>Smartphone always available/can be carried easily/unobtrusively/smaller than a laptop Smartphone can use 3G/4G whereas laptop is restricted to WiFi/cable<br>Smartphone can be used for internet access by laptop/tethering of laptop to smartphone for internet access<br>Smartphone is not as good at office tasks as a laptop<br>Can connect more readily/to more services<br>Size of device may not be an issue as salesman will use a car/drive to visit. | 8 |

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| 17(a) | **Three** *from:*<br><br>Defining the project in terms of what is to be developed<br>Gathering user requirements via focus groups/workshops<br>Defining data flow<br>Plan processes for managing project<br>e.g. Risk assessment/communication between development team/quality of product<br>Planning tasks/activities. | 3 |
| (b) | ***Two** phases from, max **4** per phase:*<br><br>*Data Modelling/Requirements phase:*<br>Review/analysis of data from business model/requirements phase<br>To create sets of data objects<br>Define relationship between data objects<br>Define test plans<br>Define training strategies where required<br>Determine implementation methodology<br><br>*Process Modelling/User Design phase:*<br>Conversion of data objects from previous phase into detailed data flow<br>Define process for any changes/enhancements to data object sets<br>Define processes for adding/deleting/modifying a data object<br>Users interact with system analysts to develop models/early prototypes<br><br>*Application creation/construction phase:*<br>Development/construction of prototype by expert programmers<br>Coding may be automated<br>Coding of components carried out simultaneously/in parallel<br>User evaluation of prototype<br>...repeatedly/iterative testing by users<br>...users suggest improvements/changes to prototype as it is developed<br>update/modification of prototype<br><br>*Implementation/testing/cutover phase:*<br>Carrying out the test plan by testing the data flow<br>...testing interaction/interfaces between components<br>Testing the complete system<br>User training where required/writing training/help notes<br>Rollout of 'app' to users<br><br>*DNA business modelling/requirements phase – stated in part (a).* | 8 |

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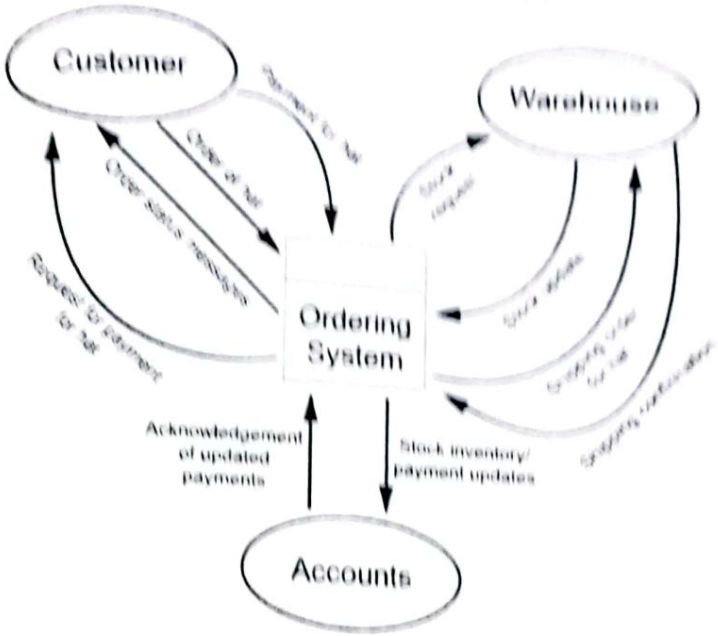
A simple context DFD would be e g




6

**Eight** *from:*

Identify all three entities: customer, warehouse, accounts
Order from customer to ordering system
Payment from customer to ordering system
Request for payment to customer from ordering system
Messages re order status payment to customer from ordering system

Stock (check) request from ordering system to warehouse
Shipping order from ordering system to warehouse
Stock update from warehouse to ordering system
Shipping confirmation from warehouse to ordering system
Stock inventory update from ordering system to accounts
Acknowledgements from accounts to ordering system.

**One** *from:*

1

To ensure that the system requirements are valid
To ensure that the system requirements are understood by all
(Can be) quickest method of obtaining feedback from users about (proposed) main features.

**Two** *from:*

2

Developers can be pressured into delivering unfinished product
Prototype may not work well enough so final product is never made/produced/required
The time spent on the prototype is lost/cannot be used in development of final product.

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| 20 | **Six** *from:*<br><br>Running in one hotel until it is working perfectly<br>When working perfectly it can be installed in the other hotels<br>The method is more effective than installing in all hotels and discovering problems<br>If it does not work only one hotel is affected not the whole chain of hotels<br>Staff at the hotel can be used to train staff at the other hotels<br>Feedback is collected and collating reviews by guests/users in one hotel<br>Will take longer to fully implement all guest access to Wi-Fi in all hotels compared to direct changeover. | 6 |
| 21 | **Six** *from:*<br><br>Observation is primary research so is valid/reliable<br>Observer can check the accuracy of the data themselves<br>Observation can be applied to almost any scenario where no verbal responses are possible/obtainable<br>Observation does not require agreement of participants so no need for observer to ask<br>People being observed do not have to give up time to answer questions/give data<br>Observation is not effective for uncertain events as event may take place when observer not present/blinks<br>Some events/phenomena cannot be observed...<br>...feelings/emotions are not observable so observation is ineffective<br>Observation is unreliable for social phenomena as bias by observer is difficult to remove/compensate for<br>Observers need to have the technical knowledge of what they are observing to be able to make valid observations of a process<br>Observation can be a slow method of research<br>Observation results are difficult to validate. | 6 |
| 22 | **Eight** *from:*<br><br>*Symptom: The air conditioning does not work at all:*<br>Check that the power supply is connected to the power outlet<br>Check that the power supply is on<br>Check if a fuse has blown/a circuit breaker has been tripped<br>Check if there has been a power failure/outage<br>Check that the timer is set correctly<br><br>*Symptom: The air-conditioning is not working properly:*<br>Check if the air intake is blocked/clear<br>Check if the air filter is dirty/clean<br>Check if the temperature has been set correctly<br>Check if there are any heaters on<br>Check if there are too many people in the room.<br><br>*Checks must be related to symptom.* | 8 |

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| 23 | **Eight** *from:*<br><br>Face, hand geometry, and iris fit this parameter are easy to read quickly/highly collectable at the door<br>Face, hand geometry, iris can be collected by machine/ computer system/ have a M/H<br>Fingerprint, facial thermogram, retina and iris have a M/H highly unique to individuals....<br>...but can be found in every individual<br>Iris, retina, voice and facial thermogram are acceptable to staff with a original collection and use at the door<br>...must not be intrusive/embarrassing when collected/read<br>parameter/have a M/H<br>Face, voice and DNA fit this parameter are difficult/not easy to circumvent to prevent copying/use by several individuals<br>Fingerprint, retina, iris, DNA do not change over time/are permanent so readings are repeatable<br>...facial thermogram is not permanent<br>Voice is most acceptable, but not very unique<br>Facial thermogram is unique, acceptable and easily collectable but changes over time so would need to be remeasured often<br>Fingerprint, Iris, Retina are most unique, collectable and accepted | 8 |
| 24 | **Eight** *from:*<br><br>Install and start the new system alongside the old system<br>Copy/set up all accounts services to the new system<br>Allow some staff and some/new customers to use services on new system<br>Switch all services to new system once it is installed and running<br>Compare results from new system/performance of new system with old/current system over a period of time<br>Period of time long enough to test/try all provided services<br>Keep old/current system running to ensure that no features are lost/in case new system fails<br>Ensure that all services are duplicated properly/in full<br>No perceived difference in services by staff or customers<br>Revert to old/current system if new system needs to be updated/amended/maintained during testing/parallel running time period<br>Once new system has proved successful complete switch to new system<br>Retain old system as backup in case of failure of new system for a period of time/archive. | 8 |

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| 25 | **Eight** *from e.g.:*<br><br>Focus group is an interview with a small number of respondents conducted by a trained interviewer / moderator<br>Members often have similar backgrounds / expertise in order to pool ideas / views<br>Representatives of the organiser / stake holders may be present to gather views / suggest ideas<br>Informal so that respondents can interact in a natural manner and freely give their views<br>Interviewer / moderator may have a guide / agenda to lead the discussion to a conclusion as the session progresses<br>Can provide accurate information in a short time<br>Can be less expensive that other methods of gathering information<br>Can be more expensive if carried out over e.g. national areas to gather information from wide range of people<br>Results / views can be affected by presence of observers / representatives of interested parties<br>Validity of outcomes can be questionable as participants may not be independent / be affected by presence or stake holders<br>Outcomes may not be kept confidential as participants are often from external sources. | 8 |
| 26 | **Six** *from:*<br><br>Perpetrators are the attackers and include e.g. script kiddies, crackers, hackers, terrorists, business competitors, (foreign) governments who carry out the crimes / intrusions<br>Each type of perpetrator has different skills / aims that can be identified by an analysis<br>.. the higher the skill, the higher the risk of crime being perpetrated<br>Analysis of their actions is carried out by the company / victim agents / representatives who design / implement the plan for disaster recovery<br>Allocation of resources to disaster recovery from cyber threats depends on likelihood of perpetrators succeeding / wishing to / probability of attack on the company<br>Analysis will define / determine the type of resource allocated e.g. firewalls / antivirus / antispyware software<br>Intrusion detection systems can be deployed to combat the type of perpetrator identified by the analysis<br>Resources can be targeted at the type of intruder / risk identified by the analysis of who / what is likely to be of concern. | 6 |

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| 27 | ***Three from:***<br>***Max One*** *from*<br>Alpha testing is carried out by the developers whereas beta testing is carried out by users<br>Alpha testing includes both black box testing and white box testing<br>Alpha Testing is carried out before the launch of software product into the market<br>Beta testing is always a black box testing or a functional testing<br>Beta Testing is done at the time of software product marketing<br>***Max Three*** *from*<br>Beta testing reduces product failure risks<br>Beta testing audiences give a more objective view than employees carrying out alpha testing<br>Beta testing is carried out on a nearly complete system whereas alpha testing will encounter far more bugs.<br>Alpha testers will provide a more technical analysis of the faults of the system. | 3 |
| 28 | *Command word: Evaluate: discuss the importance of, weigh up, the advantages and disadvantages, judge the overall effectiveness, weigh up your opinions.*<br>***Eight*** *from:*<br>*Advantages:*<br>Large amounts of information may be gathered from many responders in a shorter time than interviewing<br>Unlike with questionnaires, interviewees might try and provide answers which they think the interviewer wants to hear<br>Can be carried out by any number of researchers with little effect on the reliability and validity of the data<br>Easier to analyse quantitatively than interviews<br>*Disadvantages:*<br>Cannot see the process as a whole as you would with observation<br>Cannot move away from their 'script' and ask a more in-depth question as they could with interviews<br>Cannot interpret body language as would be possible with observation/interviews<br>Do not have to arrange a set time as would be required for interviews<br>Questionnaires can lead to people not telling the truth as they are anonymous, which is less likely with interviews<br>Questions cannot be changed once they are typed up unlike interviews<br>Follow up questions cannot be asked unlike interviews<br>More difficult to interpret emotions/feelings on a subject<br>Cannot determine how much thought/consideration has been given to the answers by respondents<br>Cannot have questions explained as to their purpose/meaning unlike interviews. | 8 |

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| 29(a) | *Four from:*<br>Project/model/product is broken into several/many sub projects/models/products<br>Model/product is partly built/built on previous iterations<br>Top priority/essential requirements are produced first and completed<br>Testing occurs at each iteration/incremental stage<br>As soon as a requirement is produced/testing is complete, its development is stopped/goes no further. |
| (b) | *Eight from:*<br>*Advantages:*<br>Each stage is an identifiable milestone to track progress<br>Testing is carried out at each incremental stage, allowing faults/problems to be identified/rectified quickly/before final completion<br>Testing is easier/quicker because changes are usually small at each iteration of product<br>Client/user can see/use new features and review these for any further changes<br>Product delivery/completion of early/working versions is faster than other methods of development<br>Risks can be managed better since risks are identified and handled during each iteration/incremental stage<br>Product delivery/completion of early/working versions can cost less than other methods of development<br><br>*Disadvantages:*<br>Incremental/additional changes may affect functionality of earlier versions in an unexpected manner<br>May raise problems at the end because all requirements are not produced/created/identified in product at start<br>Overall cost of many versions/increments can become exorbitant/excessive.<br><br>*Must be at least 1 advantage and 1 disadvantage for full marks.*<br>*1 mark available for a reasoned conclusion.* |

STUDENTS RESOURCE

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| 30 | *Eight from:*<br>Changeover takes place in stages by replacing one part/area then another<br>Parts of the old system are used alongside/with newly installed parts<br>Costs of implementation can be spread over time as all hardware/software is not installed at once<br>New systems can be used alongside old ones/form of parallel running with same stock control system to check suitability/functionality<br>If (one/individual) new POS system does not work properly old ones can be used to avoid customer dissatisfaction at sales points<br>Staff/user training can be carried out in stages by rotating staff around departments/areas<br>...with trained staff assisting those being trained<br>Staff/users can be familiarised slowly/gradually with new system and see how it works while using old one<br>If new POS system fails at checkout there is no backup/alternative available other than to move to an old POS system at another checkout with accompanying customer dissatisfaction<br>Complete changeover of all POS systems will take much longer than e.g. direct changeover of all POS systems<br>Disruption to checkouts will be longer/more intensive than e.g. direct changeover of all POS systems. | 8 |
| 31 | *Eight from e.g.:*<br>*Advantages:*<br>Accessible from anywhere/can include doctors/researchers from around the world.<br>Interaction between experts from different areas is possible to gain wider opinions/comments.<br>Can develop a group opinion.<br>User groups/moderated comments can increase reliability/reduce offensive/disruptive comments.<br><br>*Disadvantages:*<br>Objectivity can be difficult to maintain when discussing medical issues.<br>Can become little more than a group chat about symptoms with no focus.<br>No way of verifying accuracy of comments.<br>Comments can be added at any time.<br>No non-verbal clues about participants are available.<br>Posting of the same comment multiple times can cause dependability/reliability of data issues.<br><br>***Must have at least one from each to gain full marks.*** | 8 |

STUDENTS RESOURCE

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| 32 | *Eight from*<br>Interviews are conducted in person or over the telephone<br>Can be formal/structured or informal.<br>Requires the production of a script which can take time/resources to create/test.<br>Language difficulties can be resolved.<br>Can encourage/allow/enable open-ended responses.<br>Further questions may be asked based on response to previous question.<br>Questions can be explained/further clarification can be added.<br>Can resolve ambiguities in responses.<br>Can achieve a high response rate.<br>Are (mostly) qualitative in outcome<br>Responders may give the answers that they think the interviewer wants to have so data is invalid/unreliable.<br>Can be (very) time consuming for interviewer and interviewee(s) resulting in increased costs.<br>Questions may be interpreted by interviewer/interviewee in different ways resulting in unreliable/invalid data.<br>Open-ended responses may be transcribed differently by different analysts. | 8 |

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| 33(a) | **Four** *from:*<br><br>*Alpha:*<br>Alpha testing is a type of acceptance testing to identify any problems before release to end users<br>Alpha testing can use white and black box techniques to simulate (typical) end user tasks<br>Alpha testers (usually) work for the software developer/in the software developer laboratory/offices<br><br>*Beta:*<br>Beta testing is carried out by (real) end users<br>Beta testing is carried out in a real/live environment/business<br>Beta testing is the final testing phase before release of product to customer/clients.<br><br>*Must have at least one of each for full marks.* | 4 |
| (b) | **Five** *from:*<br>So that the installer/technician knows what hardware/software is required<br>So that any data structures/inputs/processing/outputs can be amended by (another) programmer/analyst<br>So that any programmer/analyst can understand how the data flows through the system<br>System flowcharts so that any programmer/analyst knows how the system works<br>To provide a basis for technical writers to create user manuals/other documentation<br>To provide a reference for programmer/analyst to update the system. | 5 |
| (c) | **Four** *from:*<br>To (detect and) correct errors in the program code so that the system works properly (corrective maintenance)<br>To improve the functionality of the system to make it more suited to the needs of the business (perfective maintenance)<br>To remove unwanted functions from the system (perfective maintenance)<br>To modify the system so that it remains compatible with any changes to the technical environment/hardware of the business (adaptive maintenance)<br>To help prevent problems caused by (upcoming/possible/security/functional) vulnerabilities in the system (preventative maintenance)<br>To ensure that the system continues to work for its expected life time/as long as the business requires it. | 4 |

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| 34(a) | ***Six** from:*<br>Ensure that management/staff are prepared/aware of/trained for the changeover to determine what needs to be done after/will happen at changeover<br>Train experienced/expert staff beforehand to support other staff<br>Train technicians to maintain the new system<br>Prepare/distribute new user manuals/instructions/help services<br>Ensure that all data is suitably backed up/secured<br>Confirm that the new system hardware/software is compatible with the data from the old system<br>Ensure that the new hardware/software is ready and available for installation<br>Transfer the data from the old system to the new one<br>Test the new system to ensure that it is working/data has transferred correctly<br>Plan/amend details of training for future/new users. | 6 |
| (b) | **Two** *from:*<br>Store can change systems when it is most convenient/store is shut<br>Benefits of new system are available to all users immediately<br>Can be carried out (overnight/quickly) with minimal disruption to the store operations | 2 |
| (c) | **Two** *from:*<br>If the new system fails, the old system is not available for use in store<br>May lose data as old data/backups cannot be installed/used on new system<br>Staff have very little time to learn the new system so may make errors/mistakes | 2 |

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| 35 | **Eight** *from:*<br>Parallel running requires the new system to run/be used alongside the old system for a period of time.<br><br>*Benefits:*<br>Can ensure that the new system is running without errors by comparing results to the existing system<br>Can resolve any errors by checking with the old system to find any modifications needed<br>If the new system fails then the old system is still operating so there is no loss of data/functions/work<br>Staff can be trained on the new system in batches as the old system is still operating/not all new staff need to use the new system at once<br>Staff may be more confident in using the new system if they can check against the old system<br><br>*Drawbacks:*<br>Costs of running both systems at the same time can be expensive/prohibitive<br>Staff may have to use two/both systems and require extensive training<br>Staff may have to do twice the amount of work<br>Maintenance and checking can be frequent and time-consuming<br>Data has to be duplicated and input twice<br>Data has to be carefully checked to ensure that the same data is going into both systems.<br><br>*Must be at least one of each for full marks.* | 8 |

STUDENTS' RESOURCE



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| 36(a) | **Six** from:<br>Creation of system and software requirements for the application<br>Analysis to create models, schemes, and business rules<br>Design to create the technical designs/design specifications including e.g. language<br>Implementing the code by writing the code/units/integration of units of software<br>Creation of technical/user documentation<br>Testing using a test plan to discover and correct errors<br>Deploying the software by the installation, migration, support, and maintenance of the finished product. | 6 |
| (b) | **Six** from:<br>Alpha testing is carried out by employees of the developer whereas beta testing is carried out by clients/end users/not employees<br>Alpha testing uses a lab/test environment whereas beta testing does not require/use this/is in public<br>Alpha testing is carried out at developers' site whereas beta testing is carried out at tester/end user location<br>Alpha testing does not involve reliability testing whereas beta testing does<br>Alpha testing does not involve security testing whereas beta testing does<br>Alpha testing involves both white and black box testing whereas beta testing usually involves only black box testing<br>Critical issues can be fixed/addressed immediately during alpha testing whereas beta testing produces feedback on issues for use at later date/in later versions<br>Alpha testing ensures that the product is fit/ready for moving to beta testing phase. | 6 |
| (c)(i) | **Two** from:<br>(Teleworking is) a flexible working arrangement in which an employee carries out the duties and responsibilities from an (approved) work site (e.g. home)<br>Working at a place other than the usual place of work for that employee<br>Use of IT/computers/internet/telephones to maintain contact with employers/colleagues/customers/central office while working from home<br>Does not include work done while on official travel or while mobile. | 2 |
| (c)(ii) | **Two** from:<br>Productivity/performance may be reduced due to lack of supervision/encouragement/self-motivation<br>Developers may have more flexibility managing their hours, which could increase motivation<br>May be difficult to stop working/disconnect from work resulting in reduced personal time<br>Increased risk of health issues due to longer working hours/working longer with no distractions<br>May become less associated/identified with the software company/employers<br>May incur additional expense on e.g. heating/lighting/electricity/IT equipment<br>May have working difficulty due to distractions/family interruptions<br>May have reduced access to IT support. | 2 |

STUDENTS RESOURCE

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| 37 | Evaluate: Discuss the importance of, weigh up the advantages and disadvantages, judge the effectiveness, weigh up your opinions.<br><br>**Eight** from:<br>*Advantages:*<br>Allows more detailed answers to be collected so more data is gathered<br>Allows follow up questions to be asked so that ambiguities/incomplete answers can be clarified<br>Gather detailed data about interviewee's feelings/perceptions/opinions so wider view of responses<br>Achieve a high response rate so more data is gathered<br>Interviewee's own words are recorded so more detail is collected<br>Question wording can be customised to interviewees so that more precise answers can be gathered<br>Precise meaning of questions can be clarified/explained to respondent if e.g. they speak English as a Second Language<br>Interviewees are not influenced by others in the group, so answers are more specific to the individual<br>Interviewer can direct the focus of questioning to collect details<br>Interviewees may be less self-conscious/more confident in a one-to-one situation<br><br>*Disadvantages:*<br>Can be time-consuming to set up/interview/transcribe so fewer interviews can be done<br>Analysis of questions/feedback can be costly/expensive as it requires e.g. manual data entry<br>Different interviewers may understand/interpret/transcribe interviews in different ways so data may not be reliable<br>Quality of the data depends on the skill of the interviewer so gathered data can vary/be unreliable<br>Sample size is limited due to the availability of interviewers so data may be unrepresentative<br>Respondents may not give honest answers so data may be unreliable<br>Respondents may give answers that the interviewer wants so data may be biased.<br><br>*Must be at least 2 of each for full marks*<br>*1 mark available for a reasoned opinion/conclusion.* | 8 |

STUDENTS RESOURCE

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| 38 | *Evaluate: Discuss the importance of, weigh up the advantages and disadvantages, judge the effectiveness, weigh up your opinions*<br><br>**Eight** from<br>*Advantages:*<br>Less expensive than other methods of gathering information due to reduced costs of employing e.g. interviewers/observers/reader of documents<br>Can be targeted at specific groups of people/only at library users<br>Results can be gathered more quickly than reading documents/interviews<br>Size of sample can be controlled/scaled up with ease compared to interviews<br>Analysis of results can be automatic with online questionnaires<br>Respondents can remain anonymous<br>No time constraint on respondent/respondent can fill in questionnaire in own time<br>Unlike manual questionnaires, online questionnaire can have customised questions depending on previous answers/branching routes through questions<br><br>*Disadvantages:*<br>Respondents may not provide honest answers/may have a hidden agenda as they are anonymous<br>Respondents may not answer all questions so the data may be incomplete<br>Respondents may not understand questions/may interpret them differently/It is not known if respondents understand<br>No emotion/feelings are conveyed<br>Free response questions can be difficult to analyse<br>Precise customisation is difficult compared to interviews<br>Questionnaire may be difficult to access by disabled persons<br>Questionnaires can be boring to answer so may not get valid data.<br><br>*Must be at least 2 of each for full marks.*<br>*Must be a proper evaluation to obtain full marks.*<br>*Max 6 marks if bullets/list of points.* | 8 |

STUDENTS SOURCE

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| | Phased implementation of the new system module/part by part<br>The implementation/changeover will be done in stages so time is available for adjustments<br>Users have more time to adapt to/learn the new system so the changeover will run more smoothly<br>Technical staff can concentrate on part of the system/some users so changeover will run more smoothly<br>Problems that arise at the start/first stages are less critical than with other methods so the changeover will have fewer problems<br>Training sessions are/can be confusing for users being asked to work with the new and the old system so users are less productive<br>Several changes in documentation are often required so more time/effort/ resources are used<br>The duration of the changeover can be much longer so there is more disruption to the business/users over a longer period<br>System delivery milestone/endpoint is unclear compared to direct changeover so users are uncertain as to how long the disruption will go on/users will be disrupted for an indeterminate time period.<br>Correctness/completeness/integrity of the data has to be checked several times when a new module is introduced, resulting in a longer time for the changeover with added costs<br>A 'fall back' to the old system becomes more difficult with each new stage so if anything goes wrong/fails later data can be lost<br>The implementation may appear unclear/confusing to the employees and other users, resulting in a lack of motivation/care in the work with more errors<br>Complexity of the implementation makes it more difficult to understand/monitor so more technical support/higher costs/much longer time taken<br>Prone to make mistakes/errors/several adjustments may be needed<br>Fall back to old system becomes impossible in later phases so the changeover has to proceed to completion regardless of the consequences.<br><br>*Max 6 marks if bullets/list of points.* | 8 |

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| 40(a) | **Six** from:<br>Determine user/system requirements/aims of project<br>Create early prototype(s) that are (partly) functional very quickly<br>Gather user feedback on early prototypes<br>Use feedback to inform prototyping to create high quality prototype<br>Repeat steps/iterate prototyping and user feedback stages until product/software is finished<br>Test prototypes/software throughout development<br>Create user/technical documentation as required<br>Present/produce final product for rollout to users. | 6 |
| (b) | **Four** from:<br>Project is divided into smaller sub-tasks that teams of developers can work on concurrently<br>Sub-tasks can make use of specialised teams/skilled specialists<br>Prototypes are created quickly so user/client can see progress/working sections<br>Development time is not wasted if the project/prototype does not work as expected<br>Waterfall method needs to start again if project fails<br>RAD can adapt to changes in user requirement<br>RAD can work well when developers telework<br>Changes/amends/corrections can be made before the final product is created<br>Client/end user is not surprised/disappointed by unexpected end product. | 4 |

STUDENTS RESOURCE

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| 41(a) | **Three** from:<br>Used when the requirements of the complete/whole system are clearly defined and understood<br>Feedback from users can be early in the development process<br>Some minor details can be allowed to/must evolve with time<br>Allows (minor/small) additional/extra/required features to be added<br>Builds on a basic/recognisable foundation<br>Can divide final product into parts/modules<br>Parts can be developed separately/combined at end<br>Errors are easier to identify because testing and debugging can be done on each module<br>Product must be on to the market/available to sell early<br>New technology is being used<br>Required skill set is not yet available/will be developed during project. | 3 |
| (b) | **Three** from:<br>To locate/discover errors in the logic/calculations/formulae (in the spreadsheet)<br>To show errors in the logic/calculations/formulae (in the spreadsheet)<br>To confirm that validation routines work as expected<br>To confirm/verify/check that a given input/normal/extreme data produces the expected/correct result/output<br>To check that the spreadsheet can deal with/respond to/reject/unusual/unexpected/abnormal inputs. | 3 |
| 42 | *Analyse: explain the main points or effectiveness in detail, identify their main characteristics, examine closely.*<br><br>**Eight** from:<br>(Pilot implementation is) when a small group of users/area uses a system before the system is fully introduced (to the whole region)<br>Testing can be carried out before full implementation so errors/problems can be corrected at early stage<br>Feedback can be obtained from real users and used to improve other/rest of implementation/installation<br>Users can be trained on the pilot system/in local area before it is rolled out to all the areas<br>Installation can be refined/revised at an early stage<br>New methods/materials/techniques can be tried out without fully installing over whole area<br>Successful methods/techniques can be 'scaled up' for the full installation<br>Spreads the cost of installation/allows budgets to be determined/approved<br>Risks can be managed easier/better as only one area is affected/can monitor before full implementation<br>Results from small-scale installation may not successfully scale-up/be applicable to full installation<br>Pilot may take a long time to complete/produce results so overall project/installation may be delayed<br>Areas not chosen for the pilot installation may become disillusioned/resentful<br>Choice of this method may indicate lack of confidence in whole installation/ability to complete whole installation.<br><br>*Must be a proper analysis to obtain full marks.*<br>*Must have expansions to be a proper analysis.*<br>*Max 6 marks if bullets/list of points/characteristic.* | 8 |

STUDENTS RESOURCE

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*Analyse*: explain the main points or effectiveness in detail, identify their main characteristics, examine closely. 8

**Eight** from:
(Pilot implementation is) when a small group of users/area uses a system before the system is fully introduced (to the whole region)
Testing can be carried out before full implementation so errors/problems can be corrected at early stage
Feedback can be obtained from real users and used to improve other/rest of implementation/installation
Users can be trained on the pilot system/in local area before it is rolled out to all the areas
Installation can be refined/revised at an early stage
New methods/materials/techniques can be tried out without fully installing over whole area
Successful methods/techniques can be 'scaled up' for the full installation
Spreads the cost of installation/allows budgets to be determined/approved
Risks can be managed easier/better as only one area is affected/can monitor before full implementation
Results from small-scale installation may not successfully scale-up/be applicable to full installation
Pilot may take a long time to complete/produce results so overall project/installation may be delayed
Areas not chosen for the pilot installation may become disillusioned/resentful
Choice of this method may indicate lack of confidence in whole installation/ability to complete whole installation.

*Must be a proper analysis to obtain full marks.*
*Must have expansions to be a proper analysis.*
*Max 6 marks if bullets/list of points/characteristic.*

STUDENTS RESOURCE

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| 44(a) | **Eight** from:<br>Drop down lists offering a choice to respondent<br>Radio buttons allowing only one choice to be made<br>Text boxes to gather free response answers/comments<br>Single character boxes to ensure data entry is appropriate<br>Validation rules to ensure that only reasonable data/comments/information is/are collected<br>Validation rules place a limit on the number of characters in text boxes/in open-ended answers<br>Inclusion of instructions/help/FAQs available to assist in completing the form<br>Pop-up boxes to explain questions in more detail<br>Multi-lingual options for different languages<br>Branching logic to route participants around questions that do not apply to them<br>Progress bar so participants can see how far they have got in the questionnaire<br>Automatic survey/questionnaire expiry to set an end date for responses<br>Can re-direct to end-of survey URL/web page<br>Integration of answers from previous questions into new specific questions<br>Real-time survey results can be shown to participants<br>Results in the form of a graph can be displayed at the end of the survey/use of questionnaire<br>Can send customised email(s) to participants to remind them/as a 'thank you'/incomplete questionnaire alert<br>Can send report (for analysis) on survey/use of questionnaire/answers to specific questions to customised list of personnel<br>Can include a 'forward to' option so that participants can send the questionnaire link to others<br>Can be set up to prevent multiple responses/place a limit on responses from the same participants<br>Can include an opt-out option so that participants are not repeatedly invited to complete the questionnaire(s). | 8 |
| (b) | **Two** from:<br>Sample of respondents can be too small to provide meaningful results/statistics<br>Sample of respondents may not be representative of customers/not all customers will respond<br>No interviewer involved so no 'follow-up' questions possible<br>Customers may not give honest answers if invited by email with incentives (e.g. free sample/discount when responding)<br>Difficult to check that a respondent is a genuine customer<br>Only customers with internet access can be questioned. | 2 |

STUDENTS RESOURCE



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| 45 | **Five** from:<br>*Similarities:*<br>Last tests before software product is deemed ready for release<br>Both carried out by persons other than the programmer<br>Both have a significant impact on the final quality of the product<br>*Differences:*<br>Alpha testing uses white and black box testing whereas beta testing (usually) involves only black box testing<br>Alpha testing is carried out by employees of the software company whereas beta testing is carried out by third-parties/impartial persons<br>Alpha testing takes place under the control of the developers whereas beta testing takes place under the control of the users<br>Reliability and security of the software are covered by beta testing but not by alpha testing<br>Alpha testing is a phase that leads into beta testing.<br>*Must be at least 1 of each for full marks.* | **5** |

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| 46 | **Five** from:<br>A description of the test that was carried out/the purpose of the test<br>A description of (any) special test environment that was created for the test<br>A description of how the test was carried out<br>A description of the expected results from the test<br>A description of the actual results from the test<br>A report on whether or not the software 'passes' the test/is ready for use<br>Recommendations for retesting the software. | **5** |

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| 47 | **Eight** from:<br>The form should be straightforward/easy/simple to fill in/complete by the user to reduce simple misunderstanding of what is required<br>The form should be consistent/focus the user's attention on what is required/use icons or inverse video or blinking cursors to focus attention<br>The form should be simple to use/should use obvious navigation methods to move to correct next screens/questions<br>The form should have a clear design with enough space/large enough boxes for writing/entering text/data<br>(Clear) instructions for filling/completing the form should be included<br>The form should include interactive help/bubbles to assist the user when completing the form<br>Keep necessary keystrokes to a minimum to reduce time taken/effort/mistakes in typing<br>The form should include validation routines to check entries for unreasonable data<br>The form should use input controls/drop boxes/radio buttons to force user entries to comply with what is required<br>The form should provide immediate feedback if a user makes an error<br>Important fields should be included so important data is not overlooked/missed out<br>There should be appropriate use of white space/fill screen so the screen is not cluttered/is easy to read/it is easier to check for errors/omissions | **8** |

STUDENTS RESOURCE



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| 48 | **Six** from:<br>Determine if the new application runs/operates efficiently by saving time/resources compared to the old application<br>Determine if the new application is easy to use/can be understood by users with little extra training<br>Compare with requirements specification to check that all requirements have been addressed/go through requirements one-by-one<br>Determine if the new application actually meets the needs of the company<br>Gather feedback from users of the application using questionnaires/interviews/observation techniques<br>Check that users like the application /find the application easier to use/check whether users can suggest improvements<br>Limitations/problem/issues of the new application are identified<br>System/application development cycle is started again to correct/redesign/test and implement improvements | 6 |

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| 49(a) | ***Four** from:*<br><br>*Specify the criteria for developing/creating the new DBMS*<br>*Provide clear instructions/guidance for the developers of the new DBMS*<br>*Specify how the new system will meet user requirements*<br>Form part of a patent application for the design/product<br>Form basis of accurate costings/resource allocation for product/DBMS development<br>Be part of a legal contract between client and developers. | 4 |
| (b) | **Six** from:<br><br>An introduction to the document stating its purpose for designing the DBMS<br>A description of the intended audience of the design specification document<br>An identification of the intended product using its names and references<br>A summary of the contents of the document<br>An overview of the DBMS system to be designed with its intended functions<br>A discussion the constraints that affect the development such as use of distributed data/use of exiting modules<br>The relationship between the data elements/modules of the database<br>Description of the file requirements e.g. file/file access methods/list of fields within a record/data attributes/expected number of records<br>Description of the purpose of calculations to be included<br>Description of formulas and calculations to be used<br>Description of error handling requirements/procedures<br>Description of backup/recovery procedures/processes<br>System start-up and shutdown procedures/processes<br>Input checks performed/validation methods<br>Description of error messages produced from invalid input<br>Layout of report such as data contained in each field of each report<br>Security design such as description of access control mechanisms/audit log provisions/user authentication/encryption processes. | 6 |

STUDENTS RESOURCE



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| 50(a) | **Two** from:<br><br>Correcting a problem/issue in the system<br>After the system has already broken down/failed/not working properly<br>Restoring the functioning/operability of the system by replacing components/adjusting code. | **2** |
| (b) | **Three** from:<br><br>Diagnosing the problem (by testing the systems modules/components)<br>Ask users for/gather information about the error/problem<br>Identifying the problem/error/fault in the system<br>Removing the faulty component/isolating the faulty code/module<br>Replacing the faulty component with a new one (and testing it)<br>Updating/amending the faulty/problematic software code/module<br>Check for and removing viruses/malware/uninstalling harmful programs<br>Reformatting storage devices and perform a system restore<br>Refer to technical documentation.<br>Take notes/make a report for reference<br>Retest the system at end of process. | **3** |

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| 51 | *Discuss: write about issue(s) or topic(s) in depth in a structured way.*<br><br>**Max 1** *for good description of parallel running method of implementation*<br><br>**Six** from:<br><br>*Benefits:*<br>Can compare results from existing hardware/software/system<br>…to ensure that there are no errors<br>Can refer to/use existing hardware/software/system for reference if errors occur<br>…so that the errors can be rectified<br>Existing hardware/software/system can be used while errors/problems in new are rectified<br>…so that production is not stopped/can continue<br>Staff can be trained on new hardware/software/system while referring to existing hardware/software/system<br>…so that staff confidence can be maintained/improved<br><br>*Drawbacks:*<br>Costs of parallel running can be high as two sets of hardware/software/system have to be run at the same time<br>…requiring more power use/staff to run both sets of hardware/software/system<br>Staff may need to do twice normal workload to run two sets of hardware/software/system<br>…so production may slow down<br>Maintenance time/effort is increased as there is two sets of hardware/software/system<br>…this may slow production/increase costs<br>Requirement to input data/instructions twice which increases data entry costs/production costs/slows production time<br>Need to ensure accurate input of same data to ensure comparable results from both sets of hardware/software/system.<br><br>*Must have at least one of each for full marks.*<br>*Must be a proper discussion for full marks.*<br>*Max 4 marks if bullets/list of points.* | 6 |

STUDENTS RESOURCE





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